IN THE SPECIFICATION

Please replace the paragraph on page 3, line 21 through page 4, line 26 with the following amended paragraph.

Another desired solution for high speed data communications appears to be cable modem systems. Cable modems are capable of providing data rates as high as 56 Mbps, and ~~is~~ are thus suitable for high speed file transfer. In a cable modem system, a headend or cable modem termination system (CMTS) is typically located at a cable company facility and functions as a modem which services a large number subscribers. Each subscriber has a cable modem (CM). Thus, the CMTS facilitates bidirectional communication with any desired one of the plurality of CMs. Referring to FIG. 1c, a hybrid fiber coaxial (HFC) network 1010 facilitates the transmission of data between a headend 1012, which includes at least one CMTS, and a plurality of homes 1014, each of which contains a CM. Such HFC networks are commonly utilized by cable providers to provide Internet access, cable television, pay-per-view and the like to subscribers. Approximately 500 homes 1014 are in electrical communication with each node 1016, 1034 of the HFC network 1010, typically via coaxial cable 1029, 1030, 1031. Amplifiers 1015 facilitate the electrical connection of the more distant homes 1014 to the nodes 1016, 1034 by boosting the electrical signals so as to desirably enhance the signal-to-noise ratio of such communications and by then transmitting the electrical signals over coaxial conductors 1030, 1031. Coaxial conductors 1029 electrically interconnect the homes 1014 with the coaxial conductors 1030, 1031, which extend between amplifiers 1015 and nodes 1016, 1034. Each node 1016, 1034 is electrically connected to a hub 1022, 1024, typically via an optical fiber 1028, 1032. The hubs 1022, 1024 are in communication with the headend 1012, via optical fiber 1020, 1026. Each hub is typically capable of facilitating communication with approximately 20,000 homes 1014. The optical fiber 1020, 1026 ~~extending intermediate~~ extends the headend 1012 and, along with ~~each hub~~ hubs 1022, 1024, defines a fiber ring which is typically capable of facilitating communication between approximately 100,000 homes 1014 and the headend 1012. The headend 1012 may include video servers, satellite receivers, video modulators, telephone switches and/or Internet routers 1018, as well as the CMTS. The headend 1012 communicates

via transmission line 1013, which may be a T1 or T2 line, with the Internet, other headends and/or any other desired device(s) or ~~network~~ network(s).

Please replace the paragraph on page 11, lines 22-33 with the following amended paragraph.

FIG. 2 shows DATA layers 120a, 120b and PHYSICAL layers ~~220a, 220b~~ 130a, 130b for a representative pair of nodes 140a, 140b according to the invention. Each node has within it semiconductor device(s) that implement the PHYSICAL layer as well as the medium access control (MAC) and Link Layer portions of the DATA layer, such as that implemented by the Broadcom Corporation Model BCM 4210 Controller. As discussed above, the PHYSICAL layer is concerned with transmission and reception of bit stream traffic to and from the transmission medium. Transmitters and receivers, described in more detail below, form a transmission medium interface, and may be implemented as a single device or separate devices.

Please replace the paragraph on page 11, line 34 through page 12, line 8 with the following amended paragraph.

Referring now to FIGS. 4a and 4b, an embodiment implementing the inventive concepts is depicted wherein, for example, a device such as computer 14 can be interconnected ~~therethough~~ therethrough to premises UTP wiring as set forth in FIG. 1a, and through which the protocol set forth in FIG. 2 is processed. FIG. 4a shows in block diagram form the controller aspects of the embodiment, while FIG. 4b ~~show~~ shows typical network interface device (NID) analog front end aspects of the embodiment.

Please replace the paragraph on page 12, lines 9-27 with the following amended paragraph.

Referring to FIG. 4a, controller 300 is a fully integrated MAC/PHY device that transmits and receives data (e.g., 10 Mbps and above as implemented by the aforementioned Broadcom Corporation Model BCM ~~4210,~~ 4210 controller or, alternatively Broadcom Corporation Model

BCM~~-4211,~~ 4211 and BCM 4413 controllers). Controller 300 includes bus interface 310, such as a PCI or MSI bus interface for communication in accordance with well-known PC-based and/or peripheral/internet appliance architectures. Controller 300 also includes digital PHY 320 having a FDQAM/QAM transmitter and receiver interfacing with the analog front end and MAC 330, coupling to bus interface 310 through transmit (TX) FIFO 340 and receive (RX) FIFO 350. Bus interface 310 also has the capability of similarly communicating with other devices 360, such as a v.90 modem through a v.90 modem interface or a 10/100 Fast Ethernet bus through a 10/100 Fast Ethernet interface (collectively 360), and their respective transmit (TX) FIFO 370 and receive (RX) FIFO 380. The operations of such bus interfaces and TX/RX FIFOs are well known in the art and are not described in more detail. The operation of the MAC/PHY aspects of the embodiment are described in more detail herein below.

Please replace the paragraph on page 13, line 19 through page 15, line 12 with the following amended paragraph.

Now turning to transmitter electrical characteristics, stations at a minimum are capable of transmitting and receiving 2 MBaud modulated frames in native V2 frame format. In a preferred embodiment stations are capable of transmitting and receiving 2 Mbaud Compatibility V2 frame format. Stations at a minimum are capable of transmitting all constellations from 2 bits-per-Baud to 8 bits-per Baud (PE values 1-7) and receiving all constellations from 2 bits per Baud to 6 bits per Baud (PE values 1-5). The R.M.S. differential transmit voltage does not exceed -15 dBVrms in any 2-msec window between 0 and 30 MHz, measured across a 135-Ohm load between tip and ring for any payload encoding. The peak differential transmit voltage does not exceed 580 ~~mVpeak~~ mV_{peak} for any payload encoding at either 2~~-Mbaud~~ MBaud or 4~~-M-baud~~ MBaud. Stations that are not transmitting emit less than -65~~-dBVrms~~ dBV_{rms} measured across a 100-Ohm load between tip and ring. The electrical characteristics described below as to spectral mask apply to both the V2 native mode and the V2 compatibility mode. The V2 metallic power spectral density (PSD) is constrained by the upper bound depicted in the FIGS. 5a and 5b with the measurement made across a 100-Ohm load across tip and ring at the transmitter wire

interface. The mask applies to all payload encodings at both 2 and 4 Mbaud. The resolution bandwidth used to make this measurement is 10 kHz for frequencies between 2.0 and 30.0 MHz and 3 kHz for frequencies between 0.015 and 2.0 MHz. An averaging window of 213 seconds is used, and 1500-octet MTUs separated by an IFG duration of silence is assumed. A total of 50 kHz of possibly non-contiguous bands may exceed the limit line under 2.0 MHz, with no sub-band greater than 20 dB above the limit line. A total of 100 kHz of possibly non-contiguous bands may exceed the limit line between 13.0 and 30.0 MHz, with no sub-band greater than 20 dB above the limit line. The 10 dB notches at 4.0, 7.0 and 10.0 MHz are designed to reduce RFI egress in the radio amateur bands. The mask is tested at PE values of 1 and 2 (2 and 3 bits/symbol), as these payload encodings result in the maximum transmitted power. The absolute power accuracy is +0/-2.5 dB relative to -7 dBm, integrated from 0 to 30 MHz. The passband ripple between 4.75 and 6.25 MHz and between 8.0 and 9.25 MHz is less than 2.0 dB. The magnitude of the V2 transmitter output is upper-bounded by the temporal mask shown in FIG. 6 for a compatibility mode pulse (the symbol response of the 2.0 transmitter). The response is measured across a 100-Ohm load between tip and ring at the transmitter's WIRE interface. Output before t=0 and after t=5.0 microseconds is <0.032% of the peak amplitude. The first compatibility mode pulse in the modified AID is exactly the transmitter symbol response. The transmitter C-weighted output in the band extending from 200 Hz to 3000 Hz does not exceed 10 dBrnC when terminated with a 600 -Ohm resistive load. The transmitter emits no more than -55 dBVrms across a 50-Ohm load between the center tap of a balun with CMRR >60 dB and the transceiver ground in the band extending from 0.1 MHz to 50 MHz. The transmitter clock frequency is accurate to within +/-100 ppm over all operating temperatures for the device. The minimum operating temperature range for this characteristic is 0 to 70 degrees C. In general, a +/-50 ppm crystal meets this characteristic. The R.M.S. jitter of the transmitter clock is less than 70 psec, averaged over a sliding 10-microsecond window. The differential noise output does not exceed -65 dBVrms across a 100-Ohm load, measured from 4 to 10 MHz with the transmitter idle. There is no gain or phase imbalance in the transmitter, except with respect to constellation scaling as described above.

Please replace the paragraph on page 15, line 13 through page 16, line 12 with the following amended paragraph.

Now turning to a comparable receiver's electrical characteristics, the receiver detects frames with peak voltage up to -6 dBV across tip and ring at a frame error rate of no greater than 10^{-4} with additive white Gaussian noise at a PSD of less than -140 dBm/Hz, measured at the receiver. The receiver detects 1518-octet frames ~~frames~~ encoded as 2 bits/symbol and 2 Mbaud with R.M.S. voltage as low as 2.5 mV at no greater than 10^{-4} frame error rate. The R.M.S. voltage is computed only over time during which the transmitter is active. The receiver detects no more than 1 in 10^4 1518-octet, 2 bits/symbol, 2 Msymbol/sec frames with R.M.S voltage less than 1.0 mV. Both criteria assume additive white Gaussian noise at a PSD of less than -140 dBm/Hz, measured at the receiver, and assume a flat channel. The receiver demodulates frames with payload encoded at 6 bits/symbol, 2 or 4 Mbaud (if implemented), and differential R.M.S voltage as low as 20 mV (measured over the header) at a frame error rate less than ~~10-4~~ $\underline{10^{-4}}$ under the following conditions: (1) White Gaussian noise with PSD less than -130 dBm/Hz is added at the receiver, and (2) A single tone interferer with any of the frequency band and input voltage combinations set forth in FIG. 7. The applied voltage is measured across tip and ring at the input to the transceiver. The receiver demodulates frames with payload encoded at 6 bits/symbol, 2 or 4 Mbaud (if implemented), and differential R.M.S voltage as low as 20 mV (measured over the header) at a frame error rate less than ~~10-4~~ $\underline{10^{-4}}$ under the following conditions: (1) White Gaussian noise with PSD less than -130 dBm/Hz is added at the receiver, differential mode, and (2) A single-tone interferer, measured between the center tap of a test transformer and ground at the input to the transceiver, with any of the following frequency band and input voltage combinations set forth in FIG. 8. The common mode rejection of the test transformer used to insert the signal should exceed 60 dB to 100 MHz.

Please replace the paragraph on page 16, lines 25-34 with the following amended paragraph.

With regard to the receiver aspects in accordance with the PHY layer protocol, reference ~~in~~ is made to FIG. 11, wherein receiver functionality 900 is shown in block diagram form. Receiver functionality 900 performs the reverse of that described above for transmitter 500, namely, upon receiving a signal from 2-4 wire hybrid and performing front end processing as described in conjunction with FIG. 4b, the following occurs: QAM/FDQAM Demodulator Gap Removal, ~~Consellation~~ Constellation Decoding, De-scrambling and De-framing, as is well-known in the art given the above-defined transmitter functionality.

Please replace the paragraph on page 18, line 23 through page 19, line 7 with the following amended paragraph.

Referring again back to FIG. ~~4B~~ 4b, in one embodiment implementing the present ~~invention~~ invention, a modem operating in half-duplex mode typically leaves the transmitter connected full-time to the hybrid and transformer devices performing 4-wire to 2-wire conversion from modem to line, even though it is not active while a signal is being received. From a signal perspective, this has no consequence. However, the noise contribution from the transmitter output to the receiver input can be significant in a low-power signal environment. The addition of simple switch 435 (e.g., a two transistor transmission gate in CMOS technology) between the output of the transmitter (e.g., filter 430) and hybrid 440 reduces noise injected at the receiver input and therefore may substantially improve receiver S/N ratio. Activation of the switch can be incorporated into an automatic gain control loop with the minimum gain control setting causing the switch to turn off. Alternatively, a specific gain control code can be assigned to activate the switch, which can then be turned off (disabled) and on (enabled) in a directed manner.

Please replace the paragraph on page 19, lines 8-19 with the following amended paragraph.

As can be seen in the typical NID depicted in FIG. ~~4B~~ 4b, electronic hybrid 440 feeds signal from the transmitter back into the receiver. VGA 470 has two pairs of inputs, one fed back from the transmitter, the other a receive input from line 106. Any signal coming out of the transmitter causes a self-echo path (e.g., through the transformer depicted in FIG. 12) into the receiver that should be suppressed, such that the receiver does not get confused as to whether such self-echo is a signal coming from line 106. Noise also can get injected into the receiver from the transmitting side, even during times when there is no transmitting, since the electronics components in the transmitting path can contribute noise, even when idle.

Please replace the paragraph on page 19, lines 20-27 with the following amended paragraph.

Therefore, in accordance with the present invention, when the transmitter is not transmitting, transmit-off switch ~~435~~ 435, provided in the transmitting path, is switched off thereby blocking noise from getting injected back into the receive ~~path~~ path, which would deteriorate receiver performance. As can be seen in FIG. ~~4B~~ 4b, in the preferred embodiment the switch is located proximate to the end of the transmit path, i.e., just before combined electronic hybrid 440.